

What is claimed is:

1. A distributed traction crawler device comprising:
  - an elongated flexible drive shaft extending along a central axis;
  - a motor operatively connected to said drive shaft for rotating said drive shaft about said central axis;
  - a plurality of segments disposed over said drive shaft between a proximal end and a distal end of the crawler device, each segment having a wheel assembly including at least one drive wheel, each of said drive wheels being rotatable about a wheel axis transverse to said central axis, wherein adjacent segments are joined to each other, and wherein at least two of the segments further include a drive coupling assembly operatively connecting the wheel assembly to the drive shaft, so that rotating the drive shaft provides distributed traction force to the drive wheels of said at least two segments.
2. A distributed traction crawler device according to claim 1, wherein said drive shaft includes successive sections joined by universal joints.
3. A distributed traction crawler device according to claim 1, wherein all the segments of said plurality of segments include said drive coupling assembly, so that rotating said drive shaft provides distributed traction force to the drive wheels of all the segments.
4. A distributed traction crawler device according to claim 1 further comprising at least one steering wire extending from a head segment which is located at the distal end of said crawler device, wherein said steering wire is substantially parallel with the drive shaft.
5. A distributed traction crawler device according to claim 4, wherein said at least one steering wire extending from the head segment to a steering end effector at the proximal end of said crawler device,
6. A distributed traction crawler device according to claim 5, wherein said steering end effector is a motor.

7. A distributed traction crawler device according to claim 4, wherein said at least one steering wire includes four steering wires for effecting two axes steering.
8. A distributed traction crawler device according to claim 7, wherein the four steering wires are equally spaced about the drive shaft.
9. A distributed traction crawler device according to claim 4, wherein said motor is located at or near the proximal end of said crawler device, and wherein said at least one steering wire extend to said motor.
10. A distributed traction crawler device according to claim 4 further comprising a tether extending between a user control end and a tether distal end, said tether distal end being connected to the proximal end of said crawler device, wherein said at least one steering wire extends from the head segment along the crawler device and the tether to the user control end.
11. A distributed traction crawler device according to claim 1 further comprising a tether extending between a user control end and a tether distal end, said tether distal end being connected to the proximal end of said crawler device.
12. A distributed traction crawler device according to claim 11, wherein said motor is positioned remote from said crawler device and is operatively coupled to said drive shaft by way of a drive cable extending along said tether.
13. A distributed traction crawler device according to claim 11 further comprising a tube extending from the distal end of the crawler device along the crawler device and the tether to a user control end.
14. A distributed traction crawler device according to claim 13, wherein the tube is adapted for transmitting air.

15. A distributed traction crawler device according to claim 13, wherein the tube is adapted for transmitting fluid.
16. A distributed traction crawler device according to claim 11, wherein said tether is semi-rigid.
17. A distributed traction crawler device according to claim 11 further comprising a cable for supplying power from an external source to said motor, said cable extending along said tether.
18. A distributed traction crawler device according to claim 1, further comprising a control system located at a remote position from said crawler device, and communication link means for transmitting control signals from said control system to said motor.
19. A distributed traction crawler device according to claim 18, wherein said control system includes a joystick.
20. A distributed traction crawler device according to claim 18, wherein said crawler device further includes a tether connected to the proximal end of said crawler device, wherein said communication link means includes a cable for transmitting control signals from said control system to said motor, and wherein said cable extends along said tether.
21. A distributed traction crawler device according to claim 1, wherein said motor is adapted to selectively rotate said drive shaft in clockwise and counterclockwise rotational motions.
22. A distributed traction crawler device according to claim 1, further comprising a video camera disposed on or near a head segment located at the distal end of said crawler device.

23. A distributed traction crawler device according to claim 22, wherein the camera is remotely steerable.
24. A distributed traction crawler device according to claim 22, further comprising a communication system transmitting signals from said video camera to an external video display system.
25. A distributed traction crawler device according to claim 24, wherein said crawler device further includes a tether extending from the proximal end of said crawler device to the display system, and wherein said communication system includes a cable extending along said crawler device and said tether for transmitting signals received by said video camera to the external video display system.
26. A distributed traction crawler device according to claim 22, further comprising an orientation sensor.
27. A distributed traction crawler device according to claim 26, wherein said orientation sensor is a gravity sensor.
28. A distributed traction crawler device according to claim 26, further comprising a processing system connected to said orientation sensor and programmed to orientate images received from said video camera and displayed on a display system to an upright view based upon signals received from the orientation sensor.
29. A distributed traction crawler device according to claim 1, further comprising a light assembly mounted on a head segment located at the distal end of said crawler device.
30. A distributed traction crawler device according to claim 1, further comprising a microphone mounted on a head segment located at the distal end of said crawler device.

31. A distributed traction crawler device according to claim 30, further comprising a speaker mounted on said head segment.
32. A distributed traction crawler device according to claim 31, further comprising a cable extending from said head segment to a user control end for transmitting signals bi-directionally between the microphone, the speaker, and an operator.
33. A distributed traction crawler device according to claim 1, wherein said wheel assembly of each segment comprises two sets of wheels disposed on opposite side of said segment, each set including two drive wheels.
34. A distributed traction crawler device according to claim 1, wherein said wheel assembly of each segment comprises four sets of wheels disposed on four sides of said segment, each set including two drive wheels.
35. A distributed traction crawler device according to claim 1, wherein said at least one drive wheel of said wheel assembly of each segment has a substantial conical shape.
36. A distributed traction crawler device according to claim 1, wherein said at least one drive wheel of said wheel assembly of each segment includes circumferential tread patterns for traction.
37. A distributed traction crawler device according to claim 1, wherein said crawler device further comprises one spring between at least one set of adjacent segments biasing said adjacent segments apart.
38. A distributed traction crawler device according to claim 1, wherein said crawler device further comprises multiple springs between at least one set of adjacent segments, said multiple springs attached to and biasing the adjacent segments apart.

39. A distributed traction crawler device according to claim 1, wherein said crawler device further comprises a drive unit, said drive unit housing the motor.
40. A distributed traction crawler device according to claim 39, wherein said drive unit disposed at or near a proximal end of said drive shaft.
41. A distributed traction crawler device according to claim 40, wherein any two adjacent segments of said plurality of segments are joined by an articulated joint.
42. A distributed traction crawler device according to claim 39, wherein said drive unit is disposed between and joined to two segments of said plurality of segments.
43. A distributed traction crawler device according to claim 1, wherein adjacent segments of said plurality of segments are joined by articulated joints.
44. A distributed traction crawler device according to claim 1, wherein said motor is a hydraulic motor.
45. A distributed traction crawler device according to claim 1, wherein said motor is an electric motor.
46. A distributed traction crawler device according to claim 1, wherein said motor is a pneumatic motor.
47. A distributed traction crawler device according to claim 1, wherein said drive coupling assembly is a gear assembly.
48. A distributed traction crawler device according to claim 1 further comprising an infrared sensor.
49. A distributed traction crawler device comprising:

an elongated flexible drive shaft extending along a central axis between a proximal end and a distal end;

a drive unit disposed at the proximal end of said drive shaft, said drive unit housing a motor operatively connected to said drive shaft for rotating said drive shaft about said central axis;

a plurality of segments successively disposed over said drive shaft, each segment having a wheel assembly including at least one drive wheel, each of said drive wheels being rotatable about a wheel axis transverse to said central axis, wherein adjacent segments of said plurality of segments are joined by an articulated joint, and wherein at least two segments further includes a drive coupling assembly operatively connecting the wheel assembly to the flexible drive shaft, so that rotating said drive shaft provides distributed traction to the drive wheels of said at least two segments; and

at least one detecting means disposed on a head segment which is located at the distal end of said drive shaft.

50. A distributed traction crawler device according to claim 49 further comprising a communication system, said communication system providing a communication link between said at least one detecting means and an operator.

51. A distributed traction crawler device according to claim 50, wherein said communication system is adapted for providing two way communications.

52. A distributed traction crawler device according to claim 49 further comprising a tether connected to the drive unit.

53. A distributed traction crawler device according to claim 52 further comprising a cable for transmitting information between said at least one detecting means and a control system, said cable extending from said at least one detecting means to the control system.

54. A distributed traction crawler device according to claim 49, wherein said at least one detecting means includes a video camera.

55. A distributed traction crawler device according to claim 49, wherein said at least one detecting means includes a microphone.

56. A distributed traction crawler device according to claim 55 further comprising a speaker mounted on said head segment.

57. A distributed traction crawler device comprising:

- a drive unit housing a motor;

- an elongated flexible drive shaft extending along a central axis from a proximal end, through the drive unit, to a distal end, wherein said motor is operatively connected to said drive shaft for rotating said drive shaft about the central axis;

- a plurality of segments disposed over said drive shaft, each segment having a wheel assembly including at least one drive wheel, each wheel is rotatable about a wheel axis transverse to the central axis, wherein two segments are disposed at two opposite ends of said drive unit, wherein any other adjacent segments are joined by an articulated joint, and wherein at least two segments further includes a drive coupling assembly operatively connecting the wheel assembly to the flexible drive shaft, so that rotating said drive shaft provides distributed traction force to the drive wheels of said at least two segments.

58. A distributed traction crawler device according to claim 57, wherein all the segments of said plurality of segments include said drive coupling assembly, so that rotating said drive shaft provides distributed traction force to the drive wheels of all the segments.

59. A distributed traction crawler device comprising:

- at least two crawler units connected by an elongated tether, wherein each crawler unit comprising:

- an elongated drive shaft extending along a central axis between a proximal end and a distal end;



a motor operatively connected to said drive shaft for rotating said drive shaft about the central axis;

a plurality of segments disposed over said drive shaft, each segment having a wheel assembly including at least one drive wheel, each drive wheel being rotatable about a wheel axis transverse to the central axis, wherein adjacent segments are joined to each other, and wherein at least two segments further includes a drive coupling assembly operatively connecting the wheel assembly to the drive shaft, so that rotating said drive shaft provides distributed traction to the drive wheels of said at least two segments.

60. A distributed traction crawler device according to claim 59, wherein all the segments of the at least two crawler units include the drive coupling assembly, so that rotating said drive shaft provides distributed traction to the drive wheels of all the segments.